No. of Printed Pages : 3 **MRW–002**

MASTER OF SCIENCE (RENEWABLE ENERGY AND ENVIRONMENT) (MSCRWEE)

Term-End Examination

December, 2023

MRW-002 : HEAT TRANSFER

Time : 3 Hours *Maximum Marks : 70*

Note : *(i) Attempt any **seven** questions.*

(ii) All questions carry equal marks.

(iii) Use of scientific calculator is permitted.

(iv) Assume suitable data, if missing, any.

1. (a) Explain the mechanism of conduction heat transfer with suitable example. 5

   (b) What is thermal contact resistance ? Explain the effect of contact pressure on thermal contact resistance. 5

2. Explain the following laws and their significance in heat transfer (any ***two***) : 5+5

   (a) Stefan-Boltzmann's law

   (b) Fick's law of diffusion

   (c) Newton's law of cooling

3. Distinguish between the following (any *four*) :

   $4 \times 2\frac{1}{2} = 10$

   (a) Surface radiation and Volumetric radiation

   (b) Free and Forced convection

   (c) Emissivity and Transmissivity

   (d) Parallel flow heat exchanger and Counter flow heat exchanger

   (e) Fire tube boiler and Water tube boiler

4. Show the temperature profile for heat conduction through a plane wall of constant thermal conductivity in a straight line and derive the equation for it. 10

5. (a) What is fin effectiveness ? Discuss the effect of various parameters of fin effectiveness. 5

   (b) Determine the heat transfer rate from the rectangular fin of length 20 cm, width 40 cm and thickness 2 cm. The tip of the fin is not insulated and the fin has a thermal conductivity of 150 W/mK. The

base temperature is 100°C and the fluid is at 20°C. The heat transfer coefficient between the fin and the fluid is 30 W/m^2K.

5

6. (a) Explain Reynolds' analogy. Is there any restriction on its use ? 5

   (b) Discuss the analogy between heat and momentum transfer in turbulent flow. 5

7. (a) Derive an expression for the intensity related to emission. 5

   (b) Draw the equivalent electrical network for radioactive flux between four walls of a black body. 5

8. (a) What is fouling ? How does it affect the overall heat transfer of a heat exchanger ?

5

   (b) Describe the working of a bent tube boiler.

5

9. Write short notes on any ***two*** of the following :

5+5=10

   (a) Composite walls

   (b) Buckingham theorem

   (c) Radiation shield

   (d) NTU